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Associations between malnutrition, poor general health and oral dryness in hospitalized elderly patients

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Abstract

Objective: to obtain information about the possible relationship between symptoms and signs of oral dryness and malnutrition/poor general health in hospitalized older people.
Design: a cross-sectional clinical investigation with measurements of unstimulated salivary flow rates (USFR), stimulated salivary flow rates (SSFR), nutritional status, serum albumin concentration and an evaluation of symptoms of oral dryness and loss of appetite by a questionnaire.
Subjects and methods: a cohort of 99 elderly, non-psychiatric patients hospitalized for medical reasons; collection of demographic and health data from medical files, collection of USFR and SSFR, measurements of body mass index (BMI), lean body mass, fat body mass, serum albumin concentration; completion of a questionnaire related to symptoms of oral dryness and the patients' appreciation of their nutritional status.
Main outcome measures: SSFR and USFR.
Results: mean age of the 99 patients was 82.5 ± 4.0 years. Anthropometric examinations indicated malnutrition of severe or intermediate degree in about 50% while 46% showed moderately and 40% severely reduced albumin. Loss of appetite was present in 54% and 51% complained of oral dryness; 17% had an USFR <0.1 ml/min and 26% a SSFR <0.5 ml/min. Significant associations were found between (i) reduced salivary flow rate, malnutrition and reduced serum albumin concentration, (ii) recent loss of appetite and low serum albumin concentration and (iii) complaints of oral dryness and reduced salivary flow rates. There were also significant associations between complaints of oral dryness, loss of appetite and low BMI.
Conclusion: reduced salivary secretion and complaints of oral dryness could be signs of poor nutritional or general health status of elderly patients. Reduced salivary secretion and feeling of oral dryness could have a negative effect on alimentation, appetite and oral comfort.

Keywords: *old age, malnutrition, salivary secretion, serum albumin, xerostomia*

Introduction

With advancing age the risk of developing malnutrition increases, particularly among institutionalized patients [1]. This may be due to age-associated reductions in food intake combined with the presence of debilitating diseases, social isolation, altered health status, economic limitations and multiple hospital admissions [2, 3]. Saliva plays an essential role in protecting the oral mucosa and the teeth, in taste perception, food-bolus formation, swallowing, communication and digestion. The effect of ageing on saliva flow is unclear and it seems that it is mainly the unstimulated salivary flow rate (USFR) which is affected. This is reduced by a factor of 2–3 in elderly subjects [4, 5] while the paraffin-wax-stimulated salivary flow rate (SSFR) remains constant with age [6, 7]. However, USFR as well as SSFR rates decrease with an increase in number of medications, particular following intake of antihypertensive agents, antidepressant drugs, tranquillizers, sedatives, hypnotics or antipsychotic agents [8]. Furthermore, the degree of hydration is an important factor which regulates salivary flow [9]. Thus, malnutrition and decreased salivary flow might both be associated with medical disorders and their medication.

The purpose of the present study was to examine the relationship between indices of malnutrition, general health (serum albumin concentration), salivary secretion rate and dry mouth feeling in elderly hospitalized patients.

Patients and methods

The study included 99 patients hospitalized for various medical reasons at the University Institute of Geriatrics during two periods (1 August-1 September 1993 and 31 May-18 August 1994). Patients aged 75-95 years were included in the study after a Mini-Mental State Examination (MMSE), comprising an evaluation of the patient's immediate memory, state of orientation and attention [10]. A MMSE score of ≥21 (maximum score 30) was required to ensure satisfactory co-operation during the questionnaire and the salivary tests. The study was approved by the local ethical committee.

Information concerning the patients' age, sex, pathologies and numbers and types of current drug prescriptions was obtained from the medical files. Nutritional and medical assessments included body mass index (BMI), mid-arm circumference, triceps skinfold thickness and serum albumin level [11, 12] (Table 1). Mid-arm circumference (lean body mass) was measured in the right arm mid-way between the acromion and the olecranon processes. The following cut-off values according to Fricker *et al.* [11] and Woo *et al.* [12] for women (and, in parentheses, for men) at 70 years of age were applied: <23.1 cm (23.8 cm), severe denutrition; 23.1-25.5 cm (23.8-25.7 cm), intermediate denutrition; 25.6-29.7 cm (25.7-28.7 cm), moderate denutrition; and >29.7 (28.7 cm), no subnutrition. The triceps skinfold thickness (fat body mass) was measured using a skinfold calliper with a pressure of 10 g/mm^2 of contact area over its entire operating range. The cut-off values used were: <11 mm (<5 mm), severe denutrition; 11-14 mm (5-7 mm), intermediate denutrition; 15-21 mm (8-11 mm), moderate denutrition; and >21 mm (>11 mm), no denutrition. For serum albumin and the BMI the cut-off between normal and reduced values was set at ≥35 g/l and ≥21, respectively.

Saliva examinations were performed between 0900 h and 1100 h and the two examinations were carried out on different days. Subjects were asked not to eat or drink for 1½-2 h before the examination, which began with the determination of USFR, after which SSFR was measured [8]. Saliva was collected during 6 min and the patient was asked to spit every 2 min. The average USFR and SSFR was computed from the two samples taken at day 1 and day 2. The cut-offs between normal and reduced USFR and SSFR were set at 0.1 ml/min and 0.5 ml/min, respectively [8]. The patients were asked about feelings of oral dryness such as severity, consequences and need to drink water regularly during the night and day [13].

Statistics

The relationship between variables was assessed with the Pearson χ^2 test. The significance of differences between mean biological measures in two groups was tested with the Student's *t*-test when a normal probability plot indicated a normal distribution. When the plot indicated a non-parametric distribution, a Mann-Whitney procedure was used. Similarly, correlation was measured with Spearman *R* or Pearson *R* coefficient depending on the distribution of the data. Multivariate analysis of variance (MANOVA) was used to distinguish between two groups using the Hotelling test. Only normally distributed variables were introduced in the model. The significance level was set at $P < 0.05$.

Results

Of the 99 patients examined, 30 were men and the mean age was 82.5 ± 4.0 years. All patients suffered from one or several pathologies: 81% cardiovascular disorders, 20% diabetes mellitus, 17% gastrointestinal disorders and 17% malignancies.

The median number of drugs prescribed per patient was six (range 1-15) and 22% took drugs with a potential xerostomic effect; 16% received a nutritional supplement of protein.

The anthropometric examinations indicated malnutrition of severe or intermediate degree in about 50% of

Table 1. Anthropometric measures, body mass index and prevalence of malnutrition in 99 hospitalized elderly patients

	Mean value ± SD		Degree of malnutrition[a] (prevalence)		
Method	Men (n = 30)	Women (n = 69)	Severe	Intermediate	Moderate
Arm circumference (cm)	27.3 ± 3.4	27.0 ± 4.7	37%	10%	34%
Triceps skinfold thickness (cm)	9.4 ± 4.9	12.6 ± 5.2	34%	24%	29%
Body mass index	23.6 ± 3.8	23.2 ± 5.1		35%[b]	

[a]Criteria and classification according to Fricker *et al.* (1991) [11] and Woo *et al.* (1994) [12].
[b]Body mass index < 21.

Table 2. Relationship between mean unstimulated salivary flow rates (USFR) and complaints of oral dryness in 92 hospitalized elderly patients who completed the salivary test

	With symptom		Without symptom		
	% of patients	USFR/min	% of patients	USFR/min	*P*
Dry mouth during day	41	0.28	59	0.47	0.003
Difficulty in speaking	12	0.30	88	0.41	0.03
Water intake ≥20 times/day	32	0.29	68	0.44	0.03
Dry mouth complicates denture wearing	23	0.24	77	0.36	0.03

the patients (Table 1). The serum albumin concentration indicated that only 14% of the patients showed levels within the normal range (≥35 g/l) whereas 46% showed moderately (30–34 g/l) and 40% severely (≤30 g/l) reduced levels. There was no correlation between age and the various anthropometric measures of nutritional status or serum albumin concentration.

Appetite, malnutrition and serum albumin

Among 53 patients who indicated recent loss of appetite, a markedly lower serum albumin concentration ($P = 0.02$) was recorded. In the 35 patients who reported that loss of appetite had affected their diet over time, significantly smaller mid-arm circumference ($P = 0.05$) and lower BMI ($P = 0.05$) were observed.

Complaints of oral dryness and salivary secretion

Significantly reduced USFR was observed in the patients showing the following symptoms of oral dryness: dry mouth during day ($P = 0.003$), difficulty in speaking ($P = 0.03$), water intake ≥20 times per day ($P = 0.03$) and dry mouth complicating denture wearing ($P = 0.03$; Table 2). Furthermore, the SSFR was significantly reduced in patients showing the following symptoms of oral dryness: frequent dry mouth ($P < 0.01$), dry mouth during night ($P < 0.01$), dry mouth during day ($P < 0.0002$), difficulty in speaking ($P < 0.007$), wakes up to drink ($P < 0.03$), dry mouth complicates denture wearing ($P < 0.03$) and difficulties in eating and swallowing ($P < 0.002$; Table 3). There was no association between the age of the patients and complaints of oral dryness, USFR or SSFR.

Salivary secretion, malnutrition and serum albumin

The mean USFR was 0.39 ± 0.31 ml/min and 17% had a USFR <0.1 ml/min. The mean SSFR was 1.09 ± 0.80 ml/min and 26% had a SSFR <0.5 ml/min. Significant associations were found between USFR < 0.1 ml/min and BMI ≤ 21 ($P = 0.02$), severe malnutrition according to triceps skinfold thickness ($P < 0.05$) and mid-arm circumference ($P = 0.05$; Tables 4 and 5). Significant associations were also found between SSFR <0.5 ml/min and severe malnutrition according to triceps skinfold thickness ($P = 0.01$) and mid-arm circumference ($P < 0.05$; Table 4). Furthermore, a significant correlation was found between SSFR and the serum albumin concentration ($R = 0.31$, $P = 0.01$). There were no associations between USFR or SSFR and the intake of xerostomic drugs or the various pathologies, e.g. diabetes mellitus. However, SSFR was negatively correlated to the number of drug treatments ($P = 0.02$). Furthermore, there was a highly significant correlation between USFR and SSFR ($R = 0.60$, $P = 0.001$).

When the patients were asked about their opinion on the nutritional status, appetite and symptoms

Table 3. Relationship between mean stimulated salivary flow rates (SSFR) and complaints of oral dryness in 82 patients who completed the salivary test

	With symptom		Without symptom		
	% of patients	SSFR/min	% of patients	SSFR/min	*P*
Frequently dry mouth	52	0.90	48	1.28	0.01
Dry mouth during night	43	0.80	57	1.24	0.01
Dry mouth during day	40	0.70	60	1.30	0.0002
Difficulty in speaking	12	0.55	88	1.17	0.007
Wakes up to drink	34	0.81	66	1.24	0.03
Dry mouth complicates denture wearing	21	0.30	79	1.00	0.03
Difficulties in eating and swallowing	15	0.52	85	1.17	0.002

Table 4. Relationship between unstimulated salivary flow rate (USFR) and body mass index among 93 elderly patients who completed the salivary test

	Body mass index	
USFR (ml/min)	≥21	<21
≥0.1	54 (70%)	23 (30%)
<0.1	7 (44%)	9 (56%)
Total	61	32

$P = 0.05$.

related to oral dryness, 54% indicated that they had lost appetite and 51% complained of oral dryness.

There were no correlations between either serum albumin level or the nutritional status and occurrence of cardiovascular diseases, cancer, gastrointestinal diseases or diabetes.

Complaints of oral dryness, loss of appetite and malnutrition

Certain associations were found between symptoms related to oral dryness, loss of appetite and poor nutritional status. Thus, recent loss of appetite was significantly associated with complaints of: dry mouth ($P = 0.01$), dry mouth during night ($P = 0.03$), dry mouth when waking up ($P = 0.01$), dry mouth during the day ($P = 0.01$), dry mouth while eating ($P = 0.001$) and need to keep water near the bed ($P = 0.03$). The information that loss of appetite had affected the diet was significantly associated with the complaint that it was difficult to eat dry food ($P = 0.01$). Significantly lower BMI was observed in patients reporting the symptoms of dry mouth ($P = 0.05$) or dry mouth during day ($P = 0.04$). Using a multivariate analysis of variance BMI, mid-arm circumference and triceps skinfold thickness were, as a whole, significantly lower in patients reporting dry mouth during the day ($P = 0.05$).

Discussion

The patients selected in the present study were recently hospitalized elders with a MMSE which made an interview and salivary tests possible. Many recent reports have been published indicating that malnutrition is frequent among elderly patients in hospitals and associated with increased morbidity and mortality [14-16]. This was confirmed in the present study as there was clinical evidence of protein-energy malnutrition in about 50% whereas reduced levels of serum albumin were observed in 86%. The serum albumin level may be considered as a marker of general health or of nutritional state, while the BMI and the anthropometric measures change more slowly over time [17, 18]. This was confirmed in the present study as the serum albumin concentration was significantly lower in those reporting recent loss of appetite. On the other hand, those who reported that loss of appetite had affected their diet over time showed significantly lower arm circumference and BMI.

Xerostomia or dry mouth may develop as a result of salivary gland dysfunction due to radiation therapy for head and neck cancer, pharmacological agents or autoimmune diseases such as Sjögren's syndrome [13]. The clinical manifestations of xerostomia include a dry or burning mouth, difficulty in chewing, wearing dentures, swallowing and speaking. Although there is an age-related reduction of USFR rate, this does not cause apparent symptoms of dry mouth and the SSFR (chewing, chemical stimulation) is not affected by age [4-7, 19]. Thus, salivary gland hypofunction and

Table 5. Relationship between unstimulated and stimulated salivary flow rate and anthropometric measures of malnutrition in elderly hospitalized patients

	No. (and %) of patients, by measure and degree of malnutrition					
	Triceps skinfold thickness (cm)			Arm circumference (cm)		
	Severe	Intermediate/better	*P*	Severe	Intermediate/better	*P*
Unstimulated salivary flow rate (ml/min)						
≥0.1	20 (28%)	52 (72%)	0.05	23 (32%)	48 (68%)	0.05
<0.1	9 (60%)	6 (40%)		9 (60%)	6 (40%)	
Total[a]	29	58		32	54	
Stimulated salivary flow rate (ml/min)						
≥0.5	15 (27%	41 (73%)	0.01	17 (30%)	39 (70%)	0.05
<0.5	13 (59%)	9 (41%)		13 (59%)	9 (41%)	
Total[b]	28	50		30	48	

[a] 12 subjects refused salivary flow and/or triceps skinfold tests; 13 subjects refused salivary flow and/or arm circumference tests.
[b] 21 subjects refused tests.

xerostomia in elderly people are most often a symptom of systemic disease or xerogenic medication, not of ageing *per se* [6, 7, 20]. This was confirmed in the present study, as there was no relationship between age (within the range 75-95 years) and complaints of xerostomia or the SSFR and USFR.

Reduced USFR and SSFR were observed relatively frequently among the patients and about 50% experienced xerostomia. This could be due to the high number of medications taken in this group of patients or intake of drugs with specific xerostomic side effects [13, 21, 22]. We confirmed an association between number of medications and reduced SSFR but no association could be found between xerostomic medication and USFR or SSFR. The finding that symptoms of oral dryness were related to reduced USFR and SSFR is consistent with other studies [8, 23].

Salivary hyposecretion and complaints of oral dryness are correlated with the number of systemic disorders, the duration of the diseases and the medication as well as the number of medications [6, 7, 20, 24]. This was confirmed in the present study on hospitalized non-psychiatric patients showing a positive correlation between the serum albumin level and the SSFR. Also, the number of medications and the SSFR were negatively correlated. Furthermore, we found an association between malnutrition (low lean body mass, fat body mass and BMI) and hyposecretion of saliva and complaints of oral dryness. These relationships might be explained in several ways. First, reduced salivary flow rate and feeling of oral dryness could be side effects of drug intake associated with the patients' poor general health status [13, 25, 26]. Secondly, poor nutritional status and reduced salivary secretion/feeling of oral dryness could be the consequences of poor alimentation and insufficient intake of water (dehydration) [1, 8]. Finally, reduced salivary secretion and feeling of oral dryness could have a negative effect on alimentation, appetite and oral comfort. The latter hypothesis has been supported by the observations that xerostomia affects the ability to chew and form a food bolus and which leads to avoidance of certain foods [27] and that food preferences are related to the salivary flow rate during mastication rather than masticatory ability and efficiency [28].

In conclusion, reduced salivary secretion/feeling of oral dryness in elderly hospitalized patients could be signs of poor nutritional or general health status, probably associated with dehydration. To improve the nutritional status and patient comfort, in the long term, improved meal provision and environment, dietary supplements and regular intake of water could have a beneficial effect [29, 30]. It should be recognized, however, that malnutrition and dehydration are common symptoms in terminally ill or dying patients [31]. In these patients it is important to relieve the symptoms of dry mouth by providing them with regular sips of water, crushed ice to suck and paying meticulous attention to oral hygiene.

Key points

- Mouth dryness is an uncomfortable and important symptom which has many causes and is common in debilitated patients.
- One in five hospitalized elderly patients were taking xerostomic drugs.
- Patients with a dry mouth have reduced salivary flow rates.
- Mouth dryness is associated with inadequate nutrition and poor general health.
- Reduced salivary secretion and a feeling of oral dryness may have adverse effects on mouth comfort, appetite and alimentation.

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